UPDATING THE NAVY ENVIRONMENTAL PROTECTION DATA BASE TO INCORPORATE OIL SPILL CLEAN-UP PERFORMANCE

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UPDATING THE NAVY ENVIRONMENTAL PROTECTION DATA BASE TO INCORPORATE OIL SPILL CLEAN-UP PERFORMANCE

by

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In this thesis proposals are formulated on methods of reporting, collecting, and disseminating information to and from the Navy Environmental Protection Data Base. The reporting aspect consists of a contingency plan and two reports, an initial report and an after action report. Such a

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Updating the Navy Environmental Protection Data Base to Incorporate Oil Spill Clean-up Performance

by

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Ensign, United States Navy
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requirements for the degree of

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I. INTRODUCTION

Man has been polluting the waters of the world for years. Until the recent ecology movement and the present resource conservation program, little concerted effort has been made to curb pollution. Presently pollution is a grave problem. In an attempt to reduce pollution, agencies are investigating its causes or contributing factors. Man's carelessness with contaminating materials, such as petroleum products and industrial wastes, has aroused concern and positive action to prevent pollution and clean up accidental spills. The Navy's long concern has resulted in the establishing of the Environmental Protection Data Base to collect data on the "problem identification" of all reported oil spills.

Today more than ever there is a growing need for knowing and understanding the costs associated with oil spills. With military funds decreasing, many district commandants wonder whether it is more economical to have a civilian contractor clean the oil spills rather than use military personnel and government equipment. A preliminary version of the problem has been considered by Anderson [1], but a more detailed study requires representative information concerning the manhours and equipment used in clean-ups as well as other pertinent data. At present there is no Navy-wide standard for reporting this information. Although some district commandants have established their own methods of reporting in their own respective areas of responsibility, nothing has been done for a Navy-wide reporting system [2].

This study will address the problem of incorporating a cost figure, equipment and manhour information, and data on the surrounding conditions of an oil spill into the file structure of the Navy Environmental Protection Data Base, (NEPDB), located at Port Hueneme, California. An oil spill is classified as either an accidental or an operational spill. An operational or intentional discharge results from such activities as pumping bilges, deballasting, and off-loading contaminated fuel. Accidental spills have unintentional causes such as human factor, structural failure, tank overflow, and so forth. The study will also cover the reporting, collecting, and dissemination of information concerned with oil spills.

The remainder of this chapter consists of the congressional and naval action which led to the establishment of the NEPDB. The following chapter is a detailed description of the NEPDB. The file structure and several typical operations of the data base are discussed. A few characteristics of an ideal data base are mentioned in order to establish a foundation upon which a data base should be designed. Chapter III contains recommended measures, such as a retrieval system and a reduction of redundancy, for the data base. An oil spill contingency plan is the principal topic of chapter five. The responsibilities of the command positions and the reports that are to be forwarded to the NEPDB are explained. The dissemination of information, in particular the Accidental Oil Spill Report, from the data base is contained in the last chapter.

A. CONGRESSIONAL AND NAVAL ACTION TO REDUCE POLLUTION

In 1970, Congress passed the Environmental Quality Improvement Act which contained the policy of the United States concerning the discharging of oil. The policy stated that there should be no discharging of oil into or upon the navigable waters of the contiguous zone in quantities declared harmful by the President. These quantities were established to include discharges which violate applicable water quality standards, or cause a film or sheen upon or discoloration of the surface of the water or adjoining shorelines or cause a sludge to be deposited beneath the surface of the water or adjoining shorelines [3]. The Navy established the Environmental Protection and Enhancement Program which required that all oil spills that produce a visible sheen in U. S. navigable waters be reported immediately to the Commander of the local Coast Guard District [4].

The Navy later responded with OPNAVNOTE 6240 (11 November 1971) which established the Environmental Protection Data Base Office to collect data on the "problem identification" of all reported oil spills. In June 1973, the data base distributed their first annual report.

In the original design of the file structure of the Environmental Protection Data Base, no concern was given to the cost of cleaning-up an oil spill. When a spill was cleaned by military personnel, many were of the opinion that since military personnel with government owned equipment and material were used to clean the spill, no cost was involved.

II. THE ENVIRONMENTAL PROTECTION DATA BASE

A. PURPOSE OF ESTABLISHING

The Navy Environmental Protection Data Base was established by OPNAVNOTE 6240 in order to establish a one year reporting requirement for collecting data concerning oil spills which pollute the navigable waters of the United States, and any land spills which tend to pollute such water. The main reason for establishing the data base was that no present method existed for identifying the total impact of oil pollution problems caused by the Navy. Since oil contamination of water is a most visible and damaging form of pollution, identification of the frequency and amount of oil spillage by naval activities and vessels was the first problem to be addressed.

The OPNAVNOTE also stated that the area coordinators would implement reporting procedures for any U. S. Navy oil discharge occurring in their respective areas of operation. Figure 1 is a form used by the Fifth Naval District for reporting oil spills. Reportable spills were defined as all oil, gasoline or jet fuel spills, whether major or minor in degree, from ship, vessel, barge, aircraft, off shore or on shore system or facility [5].

B. INFORMATION TO BE COLLECTED

By this same OPNAVNOTE the Environmental Protection Data Base Office was informed to collect the following data on the reported oil spills:

1. Location of discharge (At sea, In port, Ashore).
2. Date, time, and location of discharge (latitude and longitude for at-sea discharge).

CHECK OFF LIST FOR OIL SPILLS

1. Date 10-18-74
2. Time Call Received Recall
3. Emergency No. M22450
4. Job Order No. 1645027 6501001
5. Location Pier 23
6. Time Men Clocked in 0730
7. Time Arrived on Job 0745
8. Time Departed From Job 1745
9. Time Clocked Out 1800
10. Type Equipment Used Boat, Boom, & Forklift
11. Time Navy Yard Equipment Arrived Na.
12. Approximate Gallons of Oil Removed From Water 60 Gal.
13. No. Sq. Ft. Oil on Surface Scattered
14. Type of Oil Distillate
15. No. Men on Job 3 Men (22 hours labor charged to job)
16. Amount of Material Used 2 Bags of fiberperl

GENERAL COMMENTS Job will continue tomorrow

Figure 1

3. Type of ship, vessel, craft, or facility involved.

4. Nature and quantity of pollutant.

5. Weather conditions at time of discharge (wind speed and sea state).

6. Specific cause initiating discharge, for example:

   a. Major and minor collisions with identification of object collided with.

   b. Grounding.

   c. Difficulties with at-sea fueling operation.

   d. Mechanical and structural failures.

   e. Human error.

   f. Mechanical design deficiencies.

   g. Oil in bilges and reasons for contamination.

   h. Handling of oily waste in donuts.

   i. Other.

C. FILE STRUCTURE

The Environmental Protection Data Base Office adopted the file structure found in APPENDIX A. The file structure for one report was allotted space for 200 characters. Each entry was given sufficient space to accommodate all possible values for the appropriate entry. The descriptions of all the entries were obtained from the manual for handling accidental oil spills used at the Navy Environmental Protection Data Base.

As an example, an oil spill occured in the Norfolk harbor on August 14, 1974. The spill of 90 gallons was committed by the USS COONTZ DLG-9 at 0730. The fuel spilt was naval distillate, boom was used to contain the oil, the spill was cleaned by use of a sorbent, and the cause of the spill was an overflow of the tank. The sea state

was 5 with the wind blowing at 173° at 12 knots. Figure 2 shows the form used by the data base to input the information of this spill to the master file. Figure 3 shows the appropriate file structure.

D. DATA FLOW

All ships and shore activities provide the input to the data base. Each facility provides input reports to the Navy Environmental Support Office on accidental oil spills as they occur. Currently 580 reports are submitted annually.

Once an oil spill report is received, it is classified as either an accidental or an operational oil spill. The information concerning the oil spill is transfered to a loadsheet. A loadsheet of an accidental oil spill consists of three standard form:

(1) EDPB OIL DISCHARGE - ACCIDENTAL
This form is utilized for initial reporting.

(2) ACCIDENTAL OIL SPILL CAUSE PARAGRAPH INPUT FORM
This form contains information concerning the cause of the oil spill.

(3) 80 COLUMN MACHINE LAYOUT WORKSHEET
This form is used for inputing deletions and corrections.

The loadsheet is submitted for processing by the Environmental Support Office (ESO). It is filled in by ESO from the information furnished them by the various ships, activities and air squadrons responsible for reporting spillage of oil, fuel, or waste material in any waters in which they are operating. The loadsheet will be submitted for processing when a sufficient number have been received or upon completion of a report cycle. Thus, there is no scheduled update cycle. Processing will be initiated upon receipt of the input loadsheets. The loadsheets are then submitted to the source data conversion branch for key entry on tape output.

EPOB OIL DISCHARGE-ACCIDENTAL
11NO-CBC-3900/6 (REV. 11-73)

(100) CONTROL FIELD	(200) DATE	(300) TIME
4 Ø 1 1 4 (YR SEQUENCE NO.)	7 4 A 4 G 1 4 (YEAR MONTH DAY)	Ø 7 3 Ø R (HOUR MIN ZONE)

SOURCE OF DISCHARGE

(400) SHIP/ACTIVITY NAME: USS COONTZ ☐ (X) UNKNOWN | (500) UIC:

(600) HULL NO.: DLG-9 | (2400) ☒ (A)SHIP ☐ (B)ACTIVITY ☐ (C)PLANE

(2000) NAVAL DISTRICT NO. Ø 5 ☐ (51)LANT ☐ (52)PAC ☐ (53)MIL SEA COM ☐ (25)OTHER ☐ (00)UNKNOWN

(2100) SHIP OR ACTIVITY TYPE: DLG | (2200) SHIP CLASS OR ACTIVITY LOCATION:

(700) LOCATION: ☐ (A)AT SEA ☒ (B)IN PORT ☐ (C)ASHORE

(701) LONGITUDE	(705) PORT	(709) BLDG NO. OR LOCATION
____° ____'		
(702) LATITUDE	(706) ACTIVITY	
____° ____'		

(900) AMOUNT-GAL.: 90 | OR SLICK SIZE (1000) LENGTH ____ FT (1100) WIDTH ____ FT

(1200) SLICK DESCRIPTION: ☐ (A)BARELY VISIBLE ☐ (B)SILVERY ☐ (C)SLIGHTLY COLORED ☐ (D)BRIGHTLY COLORED ☐ (E)DARK ☐ (F)DULL

(1300) FUEL TYPE
- ☐ (A)NAVAL SPECIAL FUEL OIL
- ☒ (B)NAVAL DISTILLATE
- ☐ (C)JET FUEL JP-4 & JP-5
- ☐ (D)MARINE DIESEL
- ☐ (E)LUBE OIL(9250, 2190, 2135)
- ☐ (F)GASOLINE
- ☐ (G)HYDRAULIC FLUID
- ☐ (H) OIL/WATER (BILGE)
- ☐ (I)DIESEL
- ☐ (J)UNKNOWN
- ☐ (K) MIXTURE
- ☐ (1301)OTHER

(1400) CONTAINMENT METHOD
- ☒ (A)BOOM
- ☐ (B)HULL
- ☐ (C)CAMEL
- ☐ (D)WATER SPRAY
- ☐ (E)CHEMICAL
- ☐ (F)NONE
- ☐ (G)CONTAINED-NOG
- ☐ (1401)OTHER

(1500) CLEAN UP METHOD
- ☐ (A)SKIMMER
- ☒ (B)SORBENT
- ☐ (C)SUCTION
- ☐ (D)BUCKET
- ☐ (E)DISPERSANT
- ☐ (F)NONE
- ☐ (G)CLEANED UP-NOG
- ☐ (1501)OTHER

(1600) WIND DIRECTION	(1700) WIND SPEED	(1800) SEA STATE(0 THRU 9)
173 °	12 KNOTS	5

(1900) DISCHARGE CAUSE
- ☐ (A)VALVE MISALIGN/OPEN
- ☒ (B)TANK OVERFLOW
- ☐ (C)FUEL TRANSFER INTERNAL
- ☐ (D)FUEL TRANSFER EXTERNAL
- ☐ (E)MONITORING ERROR WATCH NOT STATIONED WATCH NOT ALERT
- ☐ (F)OONUT
- ☐ (G)COLLISION
- ☐ (H)GROUND
- ☐ (I)STRUCTURAL-DESIGN-FAILURE
- ☐ (J)AIR IN LINE
- ☐ (K)UNKNOWN
- ☐ (1901)OTHER

(2301) REMARKS

Figure 2

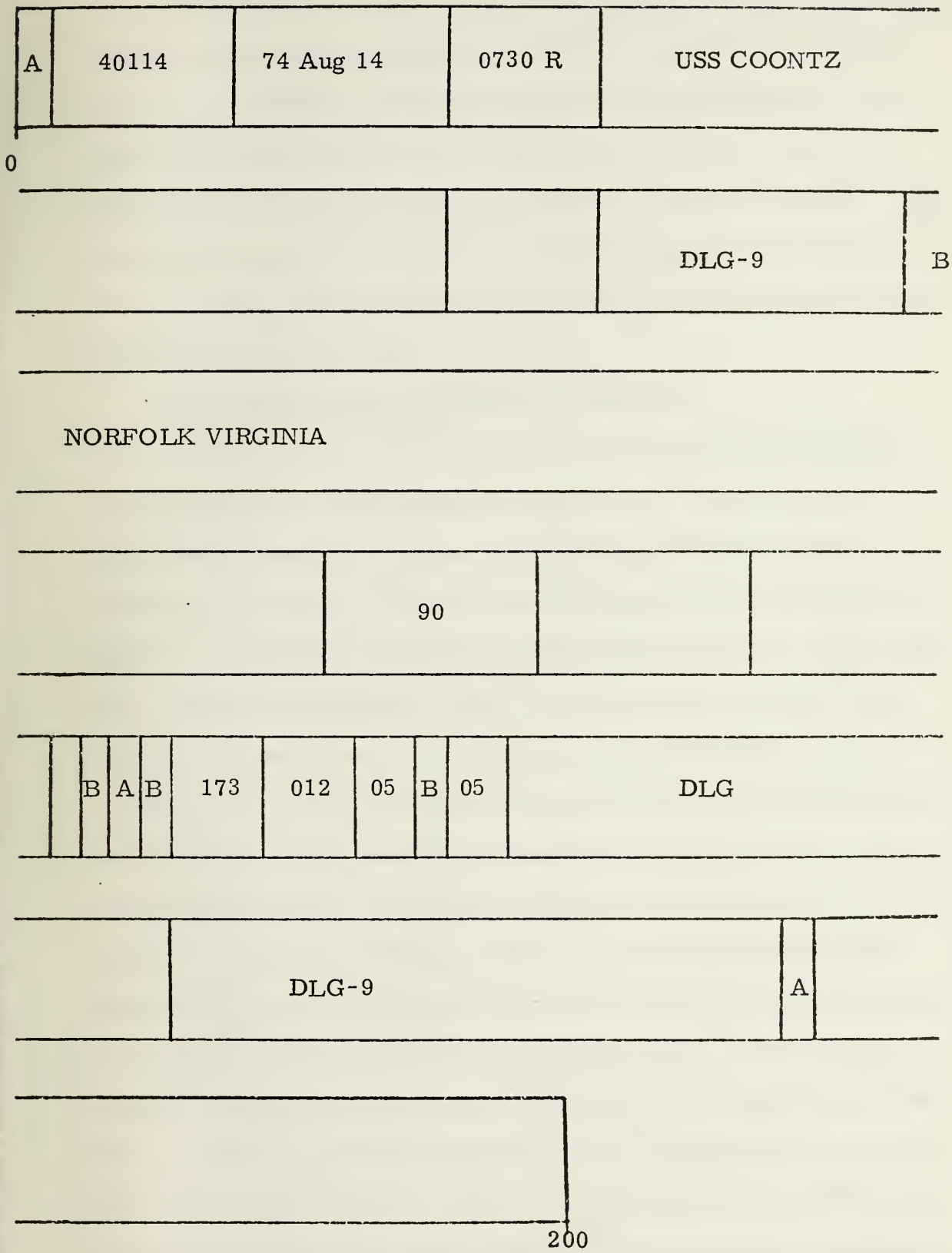

A
40114
74 Aug 14
0730 R
USS COONTZ
0
DLG-9
B
NORFOLK VIRGINIA
90
B
A
B
173
012
05
B
05
DLG
DLG-9
A
200

Figure 3

1. Updating the Master File

As figure 4 reveals, several programs are used in updating the master file. The program CE. F200M01 reads the information and an edit procedure checks the format of the information. If an error is detected, that report is typed out; otherwise, the process continues, and the information undergoes a sorting procedure. This procedure sorts the edited reports by their control field number. The file is then merged with the master file resulting in an updated accidental o/s master file.

2. Producing Scheduled Summary Reports

There are scheduled summary reports that are produced annually and sent to the appropriate commands. The summary report for accidental oil spills contain 13 report formats and a discussion of the data. This report summarizes the accidental oil spills by nine different factors; location, naval district, cause, fuel type, volume range, month, ship type, sea state and time of day. Figure 5 demonstrates how these reports are obtained.

The control cards control the type of information requested from the master file. For example, if one report requested the amount of oil spilt per month in 1972, the control cards would request the 1972 records, the amount spilt by month. A program (CE. F2010M01) reads the requested information from the control cards and proceeds to retrieve such information from the master file. Continuing the example, the program would read the master file extracting all the 1972 records. A sorting procedure sorts the extracted records by their control field number. Another program (CE. F2012M02) takes the sorted extracted file and proceeds to administer the requested

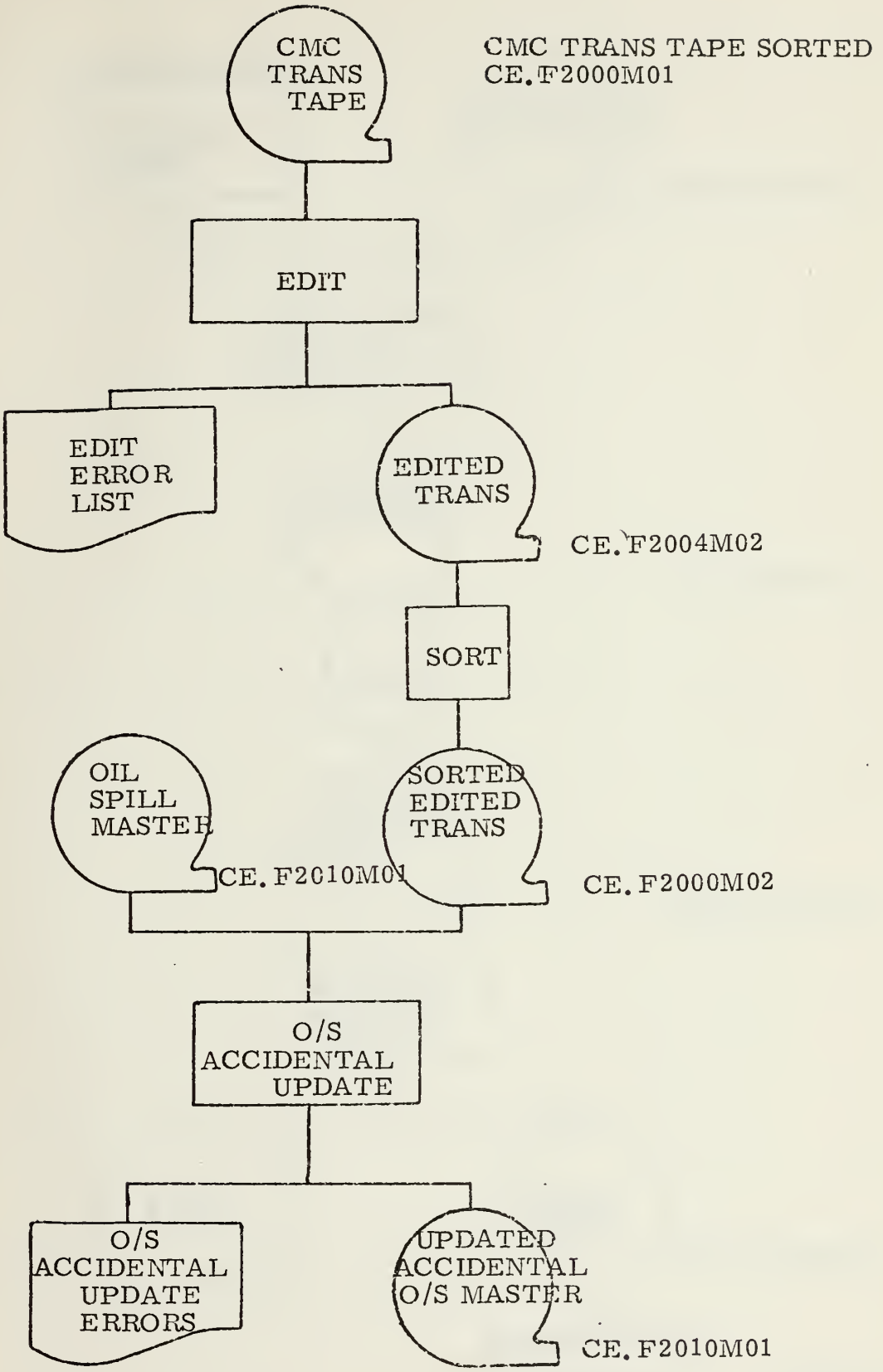

CMC TRANS TAPE
CMC TRANS TAPE SORTED
CE.F2000M01
EDIT
EDIT ERROR LIST
EDITED TRANS
CE.F2004M02
SORT
OIL SPILL MASTER
CE.F2010M01
SORTED EDITED TRANS
CE.F2000M02
O/S ACCIDENTAL UPDATE
O/S ACCIDENTAL UPDATE ERRORS
UPDATED ACCIDENTAL O/S MASTER
CE.F2010M01

Figure 4

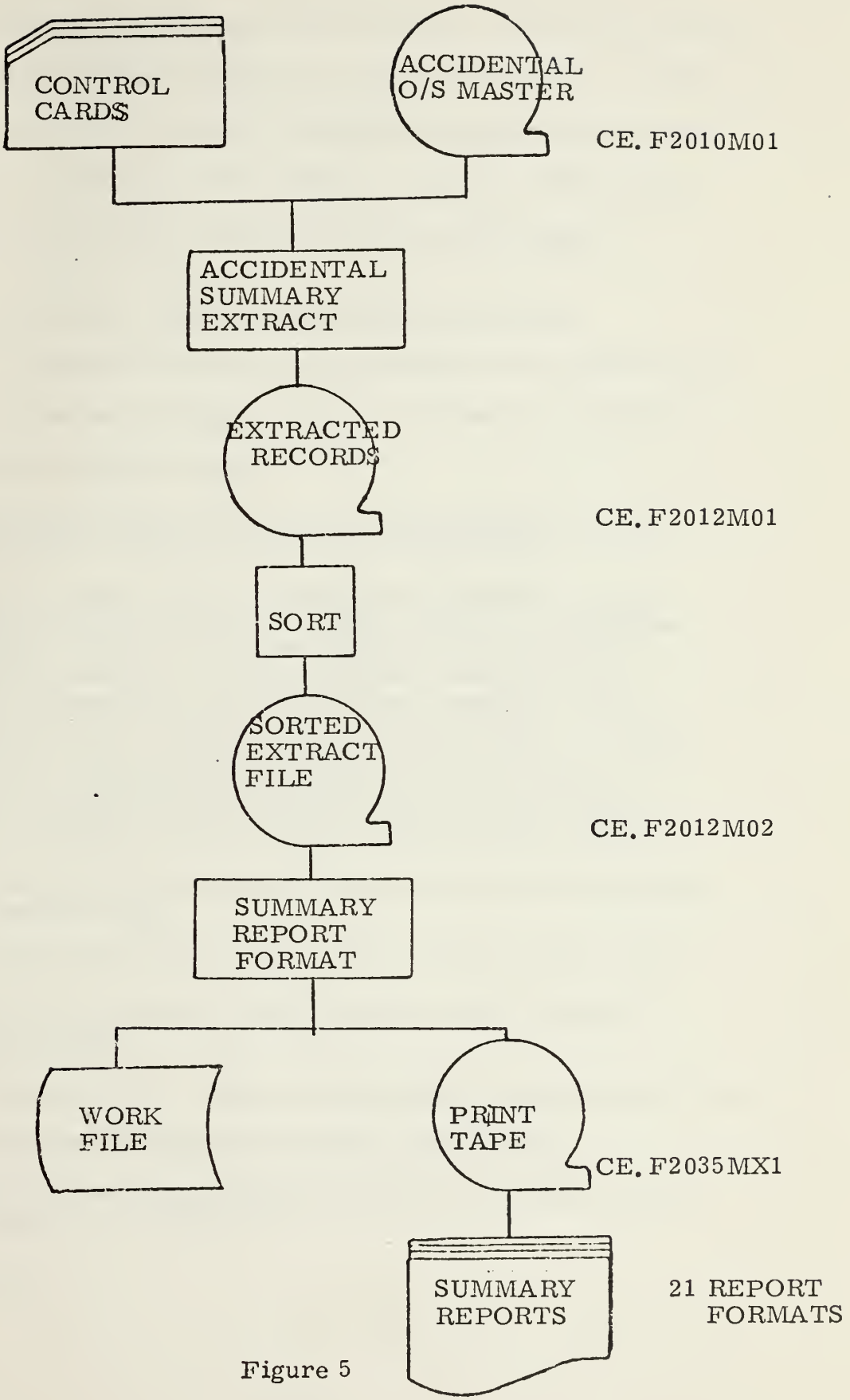

CONTROL CARD$
ACCIDENTAL O/S MASTER
CE. F2010M01
ACCIDENTAL SUMMARY EXTRACT
EXTRACTED RECORD$
CE. F2012M01
SORT
SORTED EXTRACT FILE
CE. F2012M02
SUMMARY REPORT FORMAT
WORK FILE
PRINT TAPE
CE. F2035MX1
SUMMARY REPORTS
21 REPORT FORMATS

Figure 5

report test. Referring back to the example, the test would be the amount of spillage versus the months of the year. Thus the program would sum up the amount of spillage per month of the year. Before the testing procedure concludes the results are placed into a report format. The control cards can request a maximum of 21 reports. Figure 6 shows the output printout of the requested report.

E. THE DATA FLOW THROUGH HARDWARE DEVICES

Figure 7 reveals the data flow of accidental oil spill information through the necessary hardware devices. Accidental oil spills are processed in the following manner:

A. Job control cards are read into the computer's Central Processing Unit (CPU) by the Operating System.

B. The "Operating System" loads the Oil Spill Processing Program into a computer memory area and establishes linkage between the program and all the necessary periphal devices. The Oil Spill Processing Program reads transaction input data C from a magnetic tape generated by the Source data conversion branch. The Program also reads the Current Oil Spill History master File D. By matching the transaction to the master file an "updated" master file E is created and written out on magnetic tape, an output report is also produced.

C. Transaction input data transcribed from source documents to magnetic tape.

D. Old Oil Spill History master from previous update cycle.

E. New Oil Spill History master written out for current update cycle.

F. Work area on disk use for sorting data and storing programs.

G. Intermediate storage area for the output report.

H. Output report being channelled from intermediate storage storage area to printer I.

I. Printer.

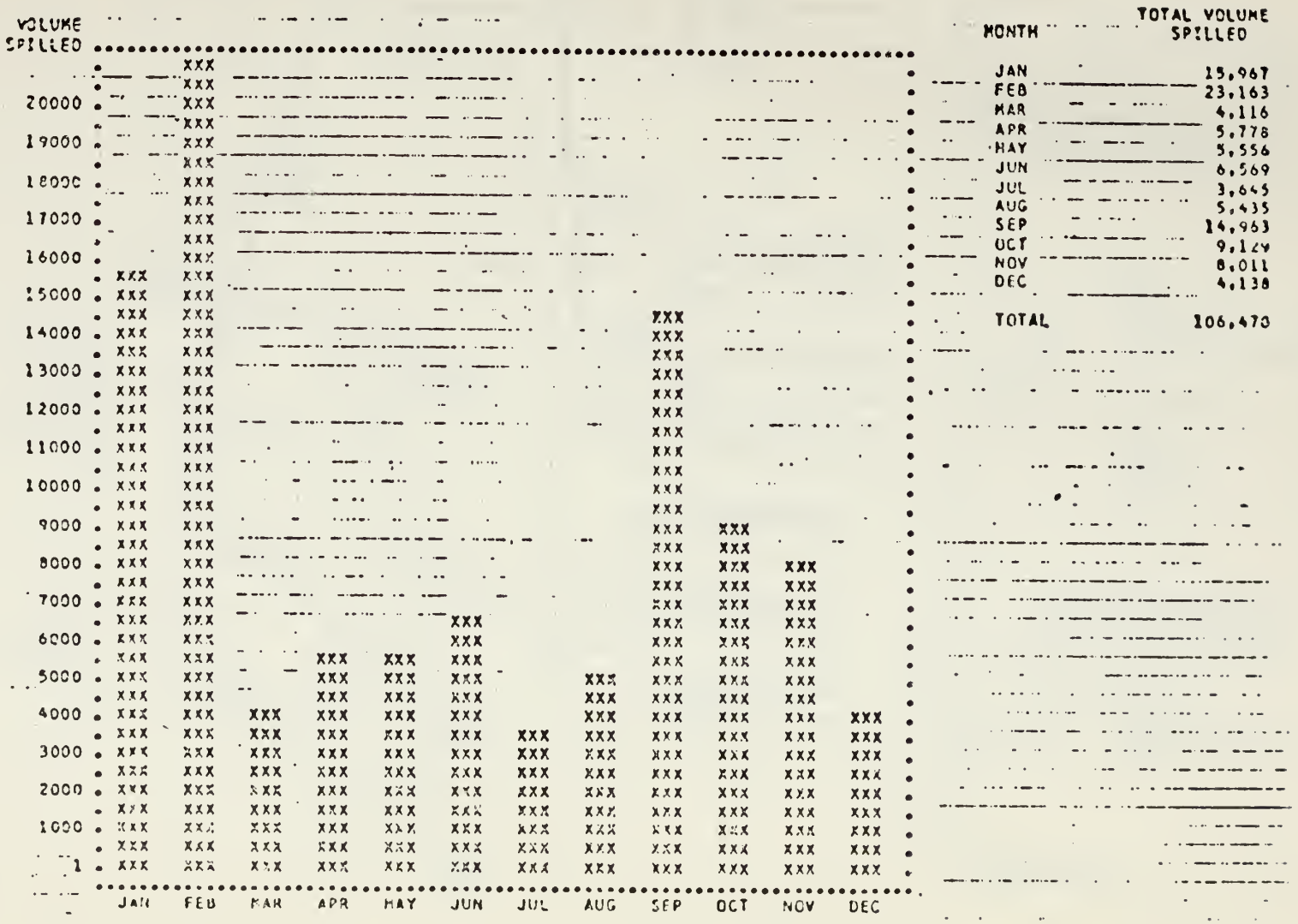

VOLUME SPILLED
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
1
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
MONTH
TOTAL VOLUME SPILLED
JAN 15,967
FEB 23,163
MAR 4,116
APR 5,778
MAY 5,556
JUN 6,569
JUL 3,645
AUG 5,435
SEP 14,963
OCT 9,129
NOV 8,011
DEC 4,138
TOTAL 106,470

Figure 6

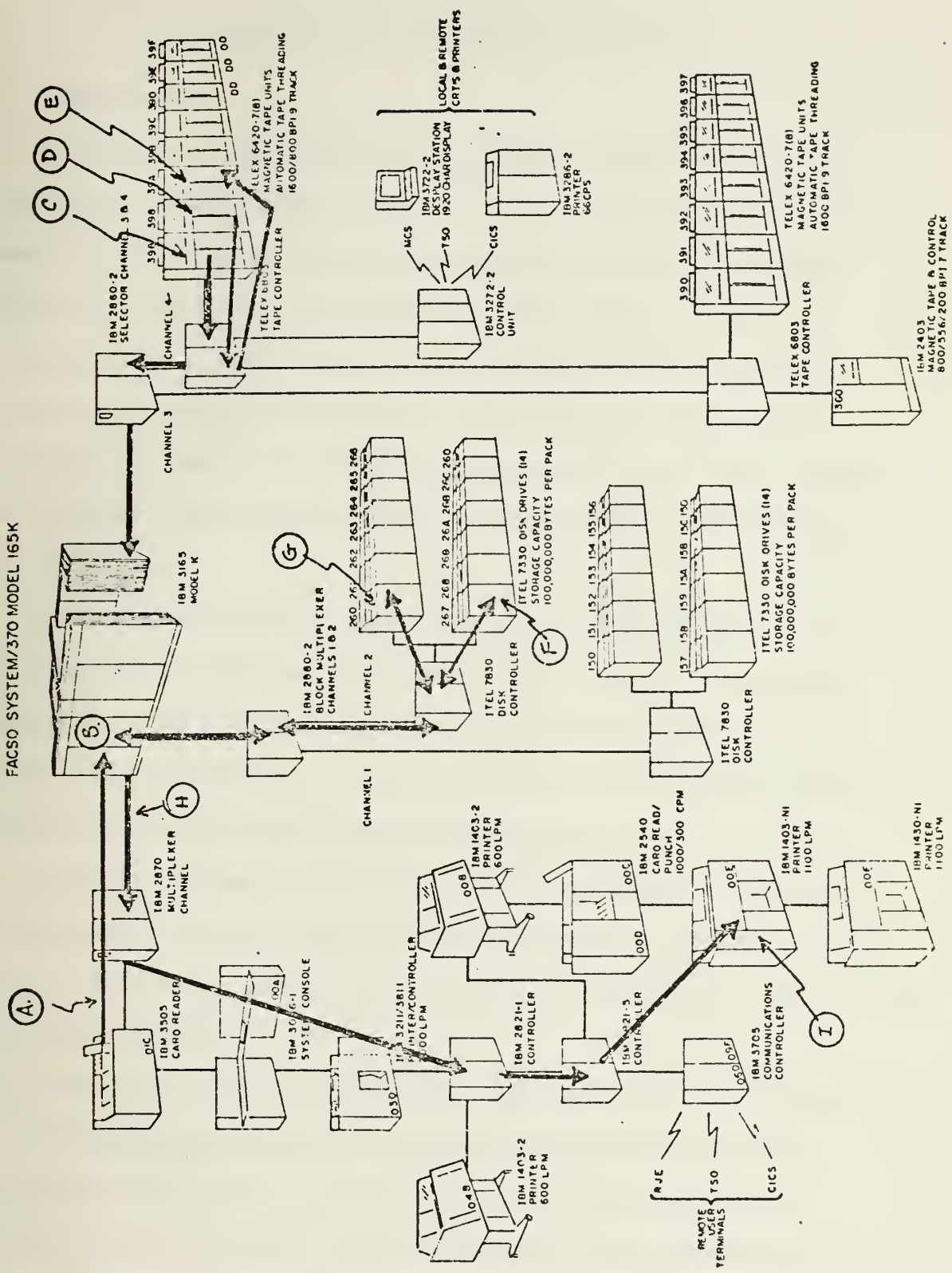

FACSO SYSTEM/370 MODEL 165K
IBM 3165 MODEL K
IBM 2860-2 SELECTOR CHANNEL 3 & 4
IBM 2860-2 BLOCK MULTIPLEXER CHANNELS 1 & 2
IBM 2870 MULTIPLEXER CHANNEL
CHANNEL 1
CHANNEL 2
CHANNEL 3
CHANNEL 4
TELEX 6420-7(8) MAGNETIC TAPE UNITS AUTOMATIC TAPE THREADING 1600/800 BPI 9 TRACK
TELEX 6803 TAPE CONTROLLER
IBM 2403 MAGNETIC TAPE & CONTROL 800/556/200 BPI 7 TRACK
IBM 3272-2 CONTROL UNIT
HCS
TSO
CICS
IBM 3277-2 DISPLAY STATION 1920 CHAR DISPLAY
IBM 3286-2 PRINTER 66 CPS
LOCAL & REMOTE CRTS & PRINTERS
ITEL 7330 DISK DRIVES (14) STORAGE CAPACITY 100,000,000 BYTES PER PACK
ITEL 7830 DISK CONTROLLER
IBM 3505 CARD READER
IBM 3066-1 SYSTEM CONSOLE
IBM 3211/3811 PRINTER/CONTROLLER 600 LPM
IBM 1403-2 PRINTER 600 LPM
IBM 2821-1 CONTROLLER
IBM 2540 CARD READ/ PUNCH 1000/300 CPM
IBM 1403-N1 PRINTER 1100 LPM
IBM 1430-N1 PRINTER 1100 LPM
IBM 3705 COMMUNICATIONS CONTROLLER
RJE
TSO
CICS
REMOTE 3270 TERMINALS
A
B
C
D
E
F
G
H
I

Figure 7

III. AN IDEAL DATA BASE STRUCTURE

A. DEFINITION

Obviously, no existing data base can be called an ideal one. Therefore, the following theoretical ideals are mentioned in order to establish a foundation upon which a data base should be designed. Firstly, a data base is a collection of master files stored on a storage device. The device should be able to access any record without the need to access any other record first. Such access can be obtained by use of an online direct access device. Thus, an ideal data base is a collection of master files stored on an online direct access device.

The ideal data base would contain all of the information that the organization would ever require. Also it would contain enough expansion room in each record to handle all future information requirements, even those which are not known at the present time, without expanding the data base record size [6].

An ideal data base should have a well-constructed control field. Such a control field contains pertinent information, reduces the time spent on searching, and gives the system the capability to retrieve single and group records.

B. EXPANSION ROOM FOR FUTURE INFORMATION REQUIREMENTS

If the requirement that the data base should contain enough expansion room in each record to satisfy all future information requirements is to be met, sufficient space could be included in any record format to allow for unlimited future expansion. However, records of excessive length will require additional storage capacity. Such a situation will also tie up input/output channels for longer periods of time.

By contrast, if little or no expansion is provided, the result will be early obsolescence. This obsclescence can force the need to redesign the data base, the accessing method, and all of the computer programs, used by the data base. This circumstance was experienced by E. Dee, P. J. H. King, and A. M. Johnson in developing their case study based on the CODASYL Data Base Task Group proposals [7]. They found that extensions to the data base entailed a review of, and modifications to, the earlier programs.

Obviously, a compromise must be made based on two major considerations, the value of existing data and the projection of future information needs. As a rule of thumb, in the design of individual record formats of a data base, sufficient space should be provided to permit the addition of data elements expected to be implemented within the next five years [6].

C. REDUNDANCY

Also in designing the record formats of a data base, redundancy should be avoided as much as possible. This is such a general problem that the Data Base Task Group included it in their second objective in their 1971 report. The objective was to permit a variety of data structures without required redundancy [8]. J. W. Foord, the Marketing Support Director of Honeywell Information Systems, defined a data base as "a collection of fields of data that are related in a meaningful way and can be accessed in different logical orders but are stored only once" [9].

D. DRAWBACKS OF THE PRESENT DATA BASE

Certainly one would expect the record formats of the Navy Environmental Protection Data Base to be different from those of an ideal system. First of all, the NEPDB lacks sufficient expansion room, in each record, to handle future information. The records are in sequential order and each record contains space for 200 characters. Each entry is given sufficient space to accommodate all possible values for the appropriate entry. The last entry of one record is followed by the first entry of the next record.

Another drawback is found in the redundancy of information. The NEPDB record formats request the ship or land activity name, the unit identification code, and the hull number. Each entry has its own record structure. The redundancy lies in the fact that the hull number is a set of characters uniquely identifying every ship in the U. S. Navy. The UIC is a five-digit code uniquely identifying all Navy shore installations. All these entries can be replaced by a record structure containing either the hull number of the ship or the UIC number of the shore installation.

The control field is a unique number assigned to the report for the purpose of referencing and editing the files. This field contains the sequence number which starts at 001 and ends at 999. Thus the first accidental oil spill report of the year will have a sequence number of 001. Therefore, the person that fills in the OIL DISCHARGE-ACCIDENTAL form refers to the last sequence number used and adds one to that sequence number to obtain the sequence number for the next report. By its structure the control field relates whether an oil spill is accidental or operational, and what year the spill occurred.

In order to retrieve the amount of oil the USS COONTZ DLG-9 spilt in the Norfolk harbor while the ship was there from June 1974 to November 1974, the NEPDB would have to search the entire file of accidental oil spills for the requested information. Due to the construction of the control field, the NEPDB cannot retrieve any particular report or group of reports.

IV. CORRECTIVE MEASURES TO THE DATA BASE

A. CONSTRUCTION OF CONTROL FIELD

A more efficient method of constructing the control field would be to construct it with information contained in the report. The control field should contain information that is pertinent to the report. If information is in the control field, it would not have to be reentered in the following record format. Thus, an organized construction of the control field would reduce the record length.

An efficient control field was constructed consisting of an eight-digit field. The naval district or fleet in which the spill occurred, the first two digits, is followed by the day of the month and the month of the year. The last number of the year is placed in the next to the last digit and the last digit identifies the spill as the first, second, . . ., or ninth oil spill in the respective area within a twenty-four hour period. Such a control field contains information that is to be reported.

B. A RETRIEVAL SYSTEM

The control field was constructed in such a manner so that the record could be retrieved. Consider the previous example, a request for how much oil did the USS COONTZ DLG-9 spill in the Norfolk

harbor between June 1974 to November 1974. The sorting routine in updating the master file sorted all inputs to the master file by the control fields of the individual records. If the control field was constructed as previously proposed, the master file would be sorted by naval districts and fleets. Thus information can be retrieved without searching the entire master file. A mere comparison of the first two digits of the control field is sufficient for locating the appropriate naval district records, Norfolk-05. A further detailed comparison of the month field would obtain the location of the records for the appropriate time period, June to November of 1974 - 0501064 to 0530114. A search would be necessary to find all the records of the USS COONTZ and obtain the requested information.

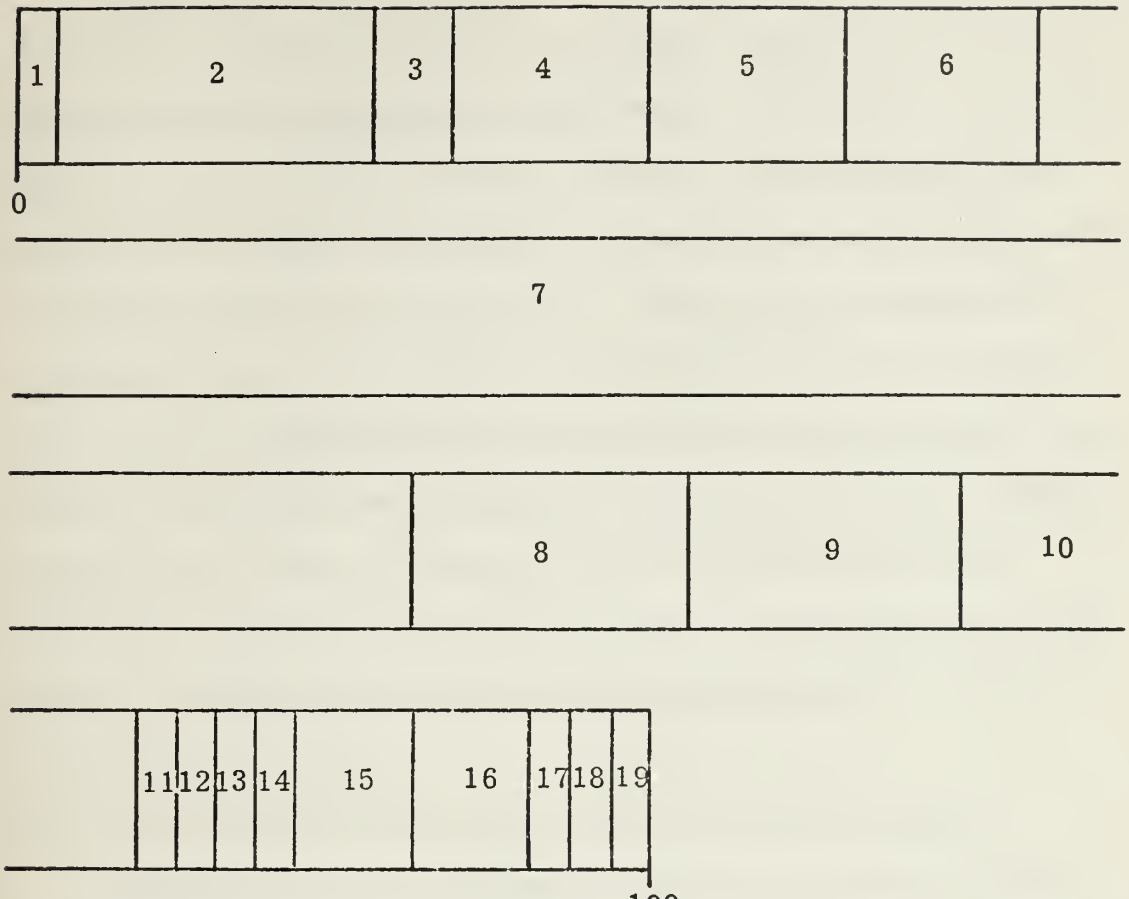
A well-constructed control field would reduce the time spent on searching and increase the efficiency in retrieving a particular report or group of reports. The above example requested the retrieval of a group of reports, that is all the reports of oil spilt by the USS COONTZ in the Norfolk Naval District from June to November of 1974. The control field adds the capability to retrieve a single report. Given the naval district and the date of the oil spill, the location of the reports of all oil spills in that naval district and during that time period can be obtained. A search for the appropriate ship or activity name would then follow in order to retrieve the single requested report. However, if the person requesting the information knew that the spill was the third oil spill reported in that particular naval district, no further search would be required. The report could be located merely by its control field. Therefore, the third oil spill

reported in the Norfolk Naval District on June 25, 1974 would have a control field of 05250643. Locating this report would entail merely comparing control fields with the above number.

A well-constructed control field can make a big difference in searching for requested information. In the present situation the difference is searching the entire file as opposed to simply comparing control fields. APPENDIX D contains a program that retrieves, updates, and checks for errors in a file using the proposed control field structure. Such capability is not found in the present system. It must search the entire file, comparing the requested information with the corresponding information of each record, looking for a match in order to retrieve the requested report.

C.) REDUCTION OF REDUNDANCY

One example of redundancy of the record entries has already been mentioned. Another example of redundancy is found with the entries ship or activity type, ship class or activity location and hull number. Referring back to OPNAVNOTE 6240, the class of ship was not included in the information to be collected. The alphabetic characters of the hull number is the ship type. However, the UIC does not contain the activity type. This problem can be solved by constructing a five-character record structure that would contain the UIC or the numeric characters of the hull number. Another record structure would contain the ship or activity type. Figure 8 shows the file structure with the new control field and the redundancy eliminated.



1. TYPE
2. CONTROL FIELD
3. YEAR
4. TIME AND ZONE DESCRIPTION
5. UIC/NUMERIC CHARACTERS OF HULL NUMBER
6. SHIP/ACTIVITY TYPE
7. LONGITUDE, LATITUDE/PORT, PIER
8. AMOUNT SPILT
9. LENGTH OF SLICK
10. WIDTH OF SLICK
11. SLICK DESCRIPTION
12. FUEL TYPE
13. CONTAINMENT METHOD
14. CLEAN UP METHOD
15. WIND DIRECTION
16. WIND SPEED
17. SEA STATE
18. DISCHARGE CAUSE
19. SOURCE CODE

Figure 8

D. DATA COLLECTION FOR AN ACCURATE COST FIGURE

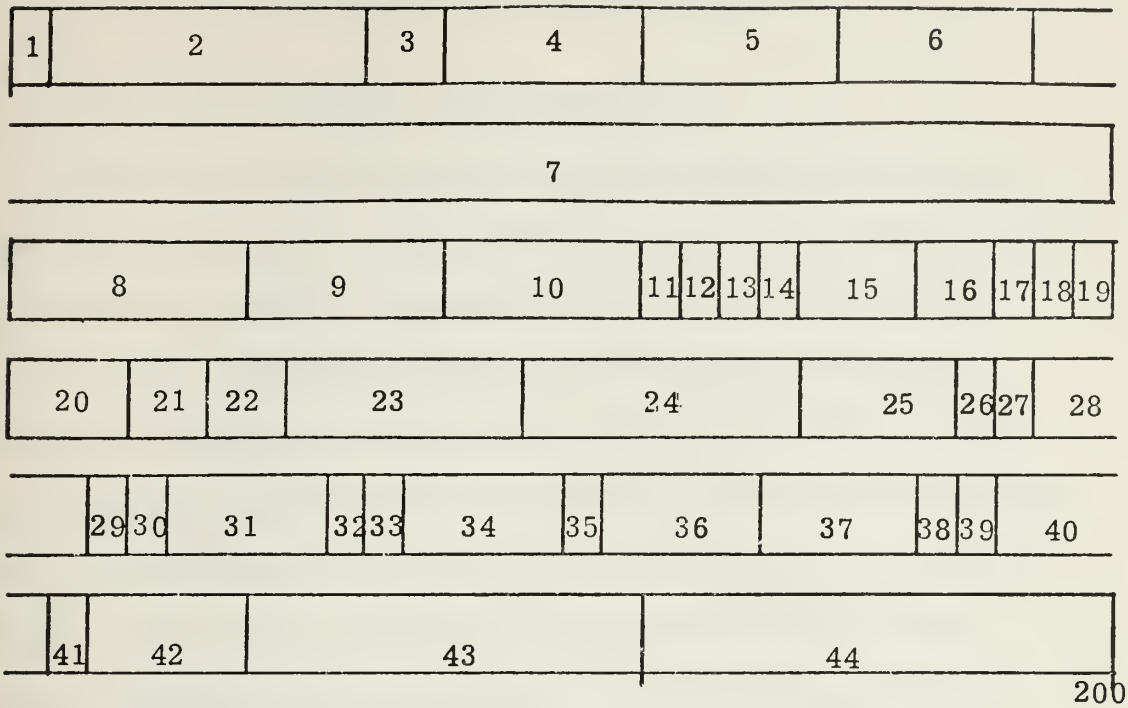
With the redundancy eliminated, the record length is reduced to half its original length. The necessary information can now be added without increasing the record size. A cost figure for an oil spill is of great need. Presently all that is collected along these lines are the amount of oil spilt, the containment and clean up method employed, and the type of oil spilt. With such information only a vague estimate can be made of the cost of an oil spill. The type of data needed consists of the amount and type of equipment used, the length of time spent containing and cleaning the spill, and a dollar figure for the entire operation. Most of the above mentioned information has been recorded by the naval districts for their own files. APPENDIX B reveals the information kept on oil spills in the Norfolk Naval District.

E. DATA COLLECTION FOR TRAFFIC IN THE HARBOR

Clearly there is a relationship between the number of oil discharges and the number of vessels in the harbor. If the harbor is empty, no oil can be spilt and if the harbor is near capacity, there are more ships to spill oil. Thus some other information that should be collected with respect to a spill is the number of vessels in the harbor at the time of the spill, the number of vessels entering and leaving the harbor, and possibly the number of vessels of the same type as the vessel that spilt the oil. Such information would give an accurate description of the traffic in the harbor, which could be related to the occurrence of a spill or to the amount of oil spilt. At present, no evidence is available to support such a statement, for the information has never been collected.

The above mentioned information can be added to the present file structure without expanding the present record length. Figure 9 shows the present file length with the added information. The record field lengths of some of the entries have been reduced because the space alotted to the entries would not be used in its entirety. For instance, presently the slick description could contain the value 9,999,999 feet which is equivalent to 1,893.9 miles. The decision for the record field lengths was obtained after studying the values reported in the ACCIDENTAL OIL SPILLS ANNUAL REPORT FOR 1972 and working with 1970 to 1974 data of oil spills in the Norfolk Naval Base area. Figure 9 reveals that the present necessary information can be added and still have ample room for future information without increasing the present record length.

Most of the entries are self-explanatory, however the equipment field may require an explanation. The typical equipment that can be used in the containment and clean-up of an oil spill is a skimmer, a boat, a forklift, a tank truck, sorbent material, and boom. The record can contain any combination of such equipment simply by entering the appropriate code of the equipment and the other requested information.



1.-19 SAME AS FIGURE 8
20. NUMBER OF VESSELS IN THE HARBOR
21. NUMBER OF VESSELS MOVING IN AND OUT OF THE HARBOR
22. NUMBER OF SIMILAR SHIP TYPE IN HARBOR
23. AMOUNT OF OIL RECOVERY
24. TOTAL COST
25. TOTAL MANHOURS
26. CODE FOR SKIMMER
27. NUMBER OF SKIMMERS USED
28. NUMBER OF HOURS USED
29. CODE FOR BOAT
30. NUMBER OF BOATS USED
31. NUMBER OF HOURS USED
32. CODE FOR FORKLIFT
33. NUMBER OF FORKLIFTS USED
34. NUMBER OF HOURS USED
35. CODE FOR BOOM
36. NUMBER OF FEET OF BOOM USED
37. NUMBER OF HOURS USED
38. CODE FOR TANK TRUCK
39. NUMBER OF TANK TRUCKS USED
40. NUMBER HOUS USED
41. CODE FOR SORBENT
42. AMOUNT OF SORBENT USED
43. NAME OF SORBENT
44. SPACE FOR FUTURE INFORMATION

Figure 9

V. OIL SPILL CONTINGENCY PLAN

A. NAVY AREA OIL SPILL COORDINATOR

Considering a data base with the previously mentioned control field and file structure, a new method of reporting is needed. An oil spill contingency plan is necessary in order that all oil spills are reported. OPNAVINST 6240.3C states that each District Commandant acting as the Navy Area Oil Spill Coordinator shall coordinate and implement the National Oil and Hazardous Substance Pollution Contingency Plan within his respective areas of responsibility. The Navy Area Oil Spill Coordinator (NAOSC) is the single, executive agent to coordinate and direct Navy pollution control efforts in the respective area. The NAOSC office identifies each spill as either the first, second, . . . , or ninth spill of the day.

B. NAVY ON-SCENE COMMANDER

The spills are reported by the appropriate Navy On-Scene Commander, the Navy Commander who has been assigned operative control of clean-up operations for a predesignated geographical area. The Navy On-Scene Commander (NOSCDR) reports the immediately available information such as the ship that spilt the oil, the amount spilt, and the type of fuel spilt. Since the NOSCDR is responsible for providing the necessary manpower, equipment, materials, and services to combat the spill, it is his responsibility to monitor and to report the usage of the above stated items. The control field number is attached to an after action report in the NAOSC's office and is also given to the NOSCDR informing him that this number

identifies the spill. The NAOSC office contacts the berthing officer to obtain the number of vessels in the harbor, number of vessels proceeding in and out of the harbor, and the number of ships in the harbor of the type that spilt the oil. The environmental conditions, sea state, wind speed and direction, are obtained from the weather bureau.

C. THE INITIAL REPORT

The immediately available information constitutes the initial report. For example, a spill of 120 gallons of diesel oil occurred in the Norfolk Naval District by the USS COONTZ DLG-9 at 1425 on April 21, 1974. The spill was the first one reported. The berthing officer reported 65 vessels in the harbor, 6 vessels proceeding in and out of the harbor, and 4 DLG's were in the harbor. The weather bureau reported a sea state of 4 with a wind speed of 7 knots at 118°. Figure 10 is the completed initial report.

The report is forwarded to the data base where the initial report is used as the form for inputting the data. It is then checked for deletions and errors. If deletions or errors are present, the respective NAOSC office is notified immediately in order to obtain the required information. If the report is correct, it follows the present routine of reports employed by the data base.

D. NAVY ON-SCENE OPERATIONS TEAM

The NOSCDR provides the necessary manpower and equipment to the scene of an oil spill for the Navy On-Scene Operations Team. The NOSOT consists of predesignated personnel trained in aspects of oil spill clean-up operation. Upon arrival to the scene, the NOSOT evaluates the situation and advises the NOSCDR of information

EPDB OIL DISCHARGE--ACCIDENTAL

CONTROL FIELD

NAVAL DISTRICT NO. 05 (51) LANT (52) PAC (53) MIL SEA COM (25) OTHER

DATE DAY 21 MONTH 04 YEAR 74

NUMBER OF SPILL 1

UIC/HULL NUMBER ____9 TIME 1425R

SHIP/ACTIVITY TYPE DLG (A) SHIP (B) ACTIVITY (C) PLANE

TRAFFIC IN HARBOR

NUMBER OF VESSELS IN HARBOR 65 NUMBER OF VESSELS PROCEEDING IN-OUT 6

NUMBER OF SIMILAR TYPE SHIPS IN HARBOR 4

LOCATION
(A) AT SEA (B) IN PORT (C) ASHORE

LONGITUDE ____° ____' LATITUDE ____° ____'

PORT NORFOLK ACTIVITY _____ BLG. NO. OR LOCATION _____

AMOUNT-GAL. OR SLICK SIZE
LENGTH _____ FT
120 WIDTH _____ FT

SLICK DESCRIPTION
(A) BARELY VISIBLE (D) BRIGHTLY COLORED
(B) SILVERY (E) DARK
(C) SLIGHTLY COLORED (F) DULL

FUEL TYPE

(A) NAVAL SPECIAL FUEL OIL (D) MARINE DIESEL (H) OIL/WATER (BILGE)
(B) NAVAL DISTILLATE (E) LUBE OIL (I) DIESEL
(C) JET FUEL JP-4 & JP-5 (F) GASOLINE (J) BUNKER C
(Y) OTHER (G) HYDRAULIC FLUID (K) MIXTURE

WIND DIRECTION 118 °

WIND SPEED 7 KNOTS

SEA STATE 4

Figure 10

required to make the initial report and additional resources needed. A listing of typical NOSOT personnel is found in APPENDIX C.

E. THE AFTER ACTION REPORT

The NOSOT cleans the spill and relays the monitored information to the NOSCDR. The NOSCDR reports the information to the NAOSC by first giving the control field number to identify the spill. The NAOSC obtains the corresponding after action report from the files and proceeds to complete the report with the information supplied by the NOSCDR. The after action report (Figure 11) is sent to the data base. If the spill was cleaned by a civilian contractor, the NAOSC should demand that a detailed account of all equipment used and manhours spent on the job be forwarded along with the bill.

Continuing the previous example, 320 feet of boom was used in the containment method and suction was incorporated as the clean-up method. The cause of the discharge was noted as a monitoring error. The person on watch was not alert. A boat was used for 35 hours, a forklift for 20 hours, and the boom contained the spill for 4 days. Approximately 100 gallons of diesel fuel was recovered at cost of $715.00. Figure 11 is the completed report.

The cost figure was obtained by use of an hourly rate. For FY74, $13.00 per hour charge was broken down as follows:

Labor (Including all overhead)	$10.92
Material	.78
Equipment	1.30
	$13.00

The number of manhours included travel time to and from the

EPDB OIL DISCHARGE-ACCIDENTAL AFTER ACTION REPORT

CONTROL FIELD NUMBER 0521044/1

CLEAN UP PROCESS
(A) MILITARY PERSONNEL (B) CIVILIAN COMPANY

DISCHARGE CAUSE

(A) VALVE MISALIGN/OPEN	(D) FUEL TRANSFER EXTERNAL	(H) GROUND
(B) TANK OVERFLOW	(E) MONITORING ERROR WATCH NOT STATIONED WATCH NOT ALERT	(I) STRUCTURAL-DESIGN FAILURE
(C) FUEL TRANSFER INTERNAL		(J) AIR IN LINE
(Y) OTHER	(F) DONUT	(K) UNKNOWN
	(G) COLLISION	

CLEAN UP METHOD

(A) SKIMMER	(D) BUCKET	(G) CLEANED UP-NDG
(B) SORBENT	(E) DISPERSANT	(H) OTHER
(C) SUCTION	(F) NONE	

CONTAINMENT METHOD

(A) BOOM	(D) WATER SPRAY	(G) CLEANED UP-NDG
(B) HULL	(E) CHEMICAL	(H) OTHER
(C) CAMEL	(F) NONE	

AMOUNT RECOVERED	TOTAL MANHOURS USED	TOTAL COST OF SPILL
100 GALS	55 HRS	$ 715.00

EQUIPMENT	AMOUNT USED	LENGTH OF TIME USED
(A) SKIMMER		
(B) BOAT	1	35 HRS
(C) FORKLIFT	1	20 HRS
(D) TANK TRUCK		
(E) BOOM	320 FT	96 HRS
(F) SORBENT		

Figure 11

scene, time to launch and recover equipment, time to recover the oil, time to clean all of the equipment used, and time used for disposal of the recovered oil.

The after action report is received by the data base, where the report is used as the form for inputting the data. The report is again checked for deletions and errors and is processed for input. The initial report record must be retrieved from the master file, and the data of the after action report added to the record.

VI. DISSEMINATION OF INFORMATION BY THE DATA BASE

A. PRESENT REPORTS

The input to the data base has been discussed. Now a look at the benefits that the NAOSCs and the NOSCDRs can receive from the data base. Presently the output of the NEPDB is three scheduled summary reports produced annually and sent to the appropriate commands. The summary reports are the following:

1. An annual Accidental Oil Spill Report, containing 13 report formats and a discussion of the data.
2. An annual Operational Oil Spill Report, containing 10 separate report formats and a discussion of the data.
3. An annual Cause Report for Accidental spills, containing a detailed analysis of causes for accidental spills.

In addition, 6 to 10 one-time unscheduled reports are produced each year to meet specific Navy needs for oil spill analysis.

B. ACCIDENTAL OIL SPILL REPORT

1. Summary by Number of Vessels in the Harbor

This paper is concerned with the first report, the Accidental Oil Spill Report. Consider that the necessary present information is contained in the Accidental Oil Spill Master File, then the present Accidental Oil Spill Report would not be complete. More information is available, thus more report formats can be made. One such format (APPENDIX E) is the summary of accidental oil spills by the number of vessels in the harbor. Studying this report over time would either support or not support the hypothesis that most oil spills occur when the harbor is near capacity, or that the most severe spills occur at that time. Presently, no evidence is available to support such an hypothesis. However, if data did support the hypothesis, the NOSCDR

could take preventive action to reduce oil spills by placing restrictions on refueling or oil transfers while the harbor is near capacity.

2. Summary by Equipment Cost and Manhours

Another format that is of great interest is the summary of equipment cost, and manhours. Refer to APPENDIX E. The report gives an accurate account of the type of equipment used. With this information the NOSCDR would have a basis to justify the buying of a new piece of equipment because of its popular use. After examining the total and average cost figures, the NOSCDR may recommend to the NAOSC that an investment in a more efficient and expensive piece of equipment, such as a large skimmer, would reduce the over all cost of an oil spill in the long run. The total and average manhour values gives added insight into the problem. A more efficient piece of equipment would require less men and less time, thus a savings in manhours. The NAOSC is aware of the validity of the data for it passed through his office.

The report provides the NAOSC with a valid picture of the entire operation. The report is a means of monitoring how well his NOSCDR's are doing in preventing oil spills. This can be done merely by comparing the occurence, cost, and manhour figures of the previous quarterly reports. It provides a report on the types of equipment used, the cost, and the manhour requirements to operate such equipment. The NAOSC has valid feedback to decide if a certain piece of equipment is worth owning.

C. CONCLUSION

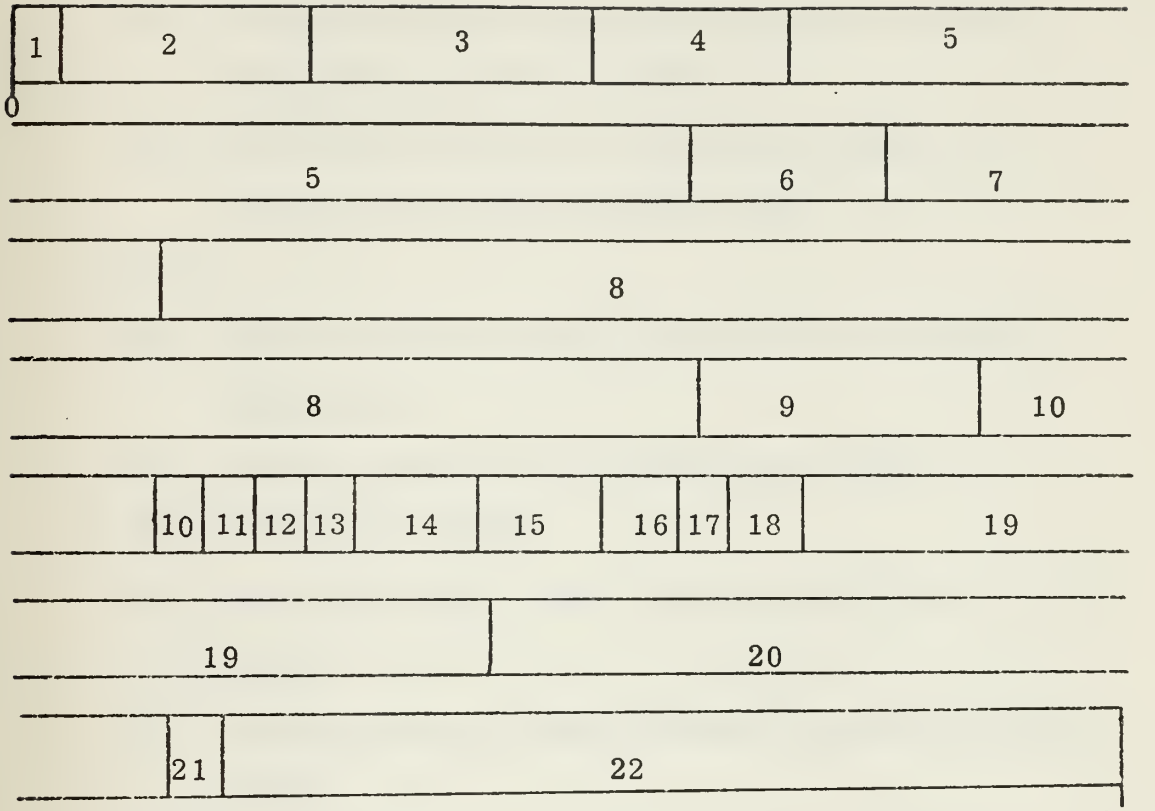
APPENDIX E is an example of the report formats that are availabe and can be incorporated in the Accidental Oil Spill Report with the earlier mentioned information added to the file structure. Such a report should be distributed to all NAOSC's on a quarterly basis.

The importance of the control field number cannot be stressed enough. The number must consist of information obtained at the origination of the reports. This is necessary in order that the NOSCDR knows exactly which information corresponds to which spill. If the data base assigned each initial report a control field number, the data base would have to contact each NAOSC and describe the spill in detail in order that the appropriate after action report can be found and the control field number attached to the report. Many errors would be committed by assigning the wrong control field number to a report. The previously described contingency plan places the responsibility of correct information on the NAOSC. If incorrect information is relayed to the data base, the summary reports will be useless and possibly detrimental.

APPENDIX A

This appendix contains a detailed description of the file structure presently used by the Navy Environmental Protection Data Base. Figure 12 shows the structure and identifies each field with a number. The fields are later described in the following pages. The descriptions of all the fields were obtained from the manual for handling accidential oil spills used at the NEPDB.

1. TYPE
   (a) A quick way to identify accidental and operational oil spills. An "A" denotes an accidental spill, a "B" denotes an operational spill.
2. CONTROL FIELD/CONTROL NUMBER
   (a) The control field or control number is a unique number assigned to the report for the purpose of referencing and editing.
   (b) The first number is the last number of the year. (3 = 1973, 4 = 1974).
   (c) The second number is "O" - this identifies accidental from operational spills.
   (d) The third three numbers are a sequence number - starting with 001 and working up to 999.
3. DATE
   (a) The date group has seven characters; the first two are the last two numbers of the year, i. e. , 73 = 1973, 74 = 1974.



1. TYPE
2. CONTROL FIELD
3. DATE
4. TIME
5. SHIP/ACTIVITY NAME
6. UIC
7. HULL NUMBER
8. LOCATION
9. AMOUNT
10. SLICK SIZE
11. FUEL TYPE
12. CONTAINMENT METHOD
13. CLEAN UP METHOD
14. WIND DIRECTION
15. WIND SPEED
16. SEA STATE
17. DISCHARGE CAUSE
18. NAVAL DISTRICT/FLEET
19. SHIP/ACTIVITY TYPE
20. SHIP CLASS/ACTIVITY LOCATION
21. SOURCE TYPE
22. REMARKS

Figure 12

(b) The third - fifth characters are the first three letters of the month in which the spill occured, i. e., Jan - January, Feb - February, etc.

(c) The sixth and seventh characters are the day (local time) when the spill occurred.

(d) If the day is not given, the date of the report or the 15th of the named month is used.

4. TIME

(a) Time is noted according to the 24'hour clock (0800, 1300, etc.).

(b) The last space is for the time zone - local.

5. SHIP/ACTIVITY NAME

The name of the ship, vessel, activity which was the source of the spill:

(a) All United States Navy ships have the prefixes USS or USNS.

(b) United States civilian ships have the prefix SS.

(c) Navy activity names consist of an abbreviation of the facility type and a location or name, i. e., NAVSTA, Alameda, NSY, Mare Island, etc.

(d) Examples: USNS SOMERS; USS KITTY HAWK; NAVSTA CHARLESTON.

6. UIC

(a) UIC (Unit Identification Code) is a five-digit code uniquely identifying all Navy shore installations and some ships.

(b) Activities must have a UIC noted.

Examples: CVA 63 - USS MIDWAY - 03363.

7. HULL NUMBER

(a) The hull number is a set of characters uniquely identifying every ship in the U. S. Navy.

(b) The first two to five characters include the ship type and whether it is in the regular or reserve fleets.

(c) All reserve fleet ships have a "T" preceeding the letters of the ship type.

(d) The last one to four characters are numbers assigned to the ship hull.

(e) Activities and aircraft have no hull numbers.

Examples: LST 1196 - Landing ship transport No. 1196; CVA 67 - Carrier No. 67; TAO 89 - Reserve Fleet oiler No. 89.

8. LOCATION

(a) Check one block depending on whether the spill source was AT SEA, IN PORT, OR ASHORE.

(b) Spills of unknown source in harbors are IN PORT.

(c) Ship spills are always AT SEA or IN PORT.

(d) Activity spills are always ASHORE.

(e) If the spill is AT SEA - fill in the latitude and longitude.

(f) If the spill is IN PORT - fill in the port and activity.

(g) If the spill is ASHORE - fill in Bldg. number of location.

9. AMOUNT

(a) Enter the amount spilled or an estimate thereof in this space. An amount must be entered - always in gallons.

10. SLICK SIZE

(a) If no amount is given but the slick dimensions and description are noted, enter those in length, width, description.

11. FUEL TYPE

(a) Check one fuel type box.

(b) OTHER is filled in when one of the coded fuel types is not applicable.

12. CONTAINMENT METHOD

(a) Check one block under 1400 for the containment method mentioned first in the report.

(b) If no containment was made check (F) NONE.

(c) (G) CONTAINED - NDG means contained, no details given.

(d) (E) CHEMICAL is like Shell Oil Herder, etc.

(e) (B) HULL refers to the ships hull.

(f) OTHER is filled in when none of the coded containment methods applies.

13. CLEAN UP METHOD

(a) Check one of the blocks or fill in OTHER for other clean up procedures used.

(b) (B) SORBENT refers to any kind of absorbent used to soak up a spill.

(c) (C) SUCTION includes pumps, etc.

(d) (E) DISPERSANT refers to a chemical dispersant.

(e) (G) CLEANED UP - NDG is used when spill is cleaned up but details are not given.

14. WIND DIRECTION

Wind direction is noted in degrees using three numbers. Examples: 045°, 215°, etc.

15. WIND SPEED

Wind speed is noted in knots.

16. SEA STATE

Sea state is a 0-9 scale describing the state of the sea.

17. DISCHARGE CAUSE

(a) Check one box for the cause of the spill.

(b) TANK OVERFLOW (B) is the most general cause.

(c) MONITORING ERROR (E) is more general than all causes except (B) (HUMAN ERROR).

(d) Spill causes that do not fit into the given categories are noted under OTHER.

18. NAVAL DISTRICT/FLEET

(a) Each spill is assigned to a fleet or naval district according to the source of the spills. If the source is unknown, then the naval district/fleet is unknown.

(b) Spills from activities are assigned a naval district according to where they are located. The areas outside the United States are assigned the following numbers:

Area	Number
Atlantic	20
Pacific	21
European	22
Washington, D. C.	23

(c) Spills by ships are assigned to their fleet:

Fleet	Number
Atlantic	51
Pacific	52
Military Sealift Command	53

(d) Spills from other sources - civilian ships, foreign ships, reserve training ships, etc., are assigned to OTHER.

(e) Spills whose source is unknown are assigned to UNKNOWN.

(f) All spills are given a number.

(g) Naval district numbers must be written in; fleet numbers are checked in the boxes.

19. SHIP OR ACTIVITY TYPE

(a) A ship type is indicated by the letters in the hull number, i. e., CVA 63 - type, CVA.

(b) An activity type is noted by the same method as in SHIP/ACTIVITY NAME. An abbreviation of the type of activity, i. e., NAD - Naval Ammunition Depot; NOS - Naval Ordinance Station, etc.

(c) Spills by planes, helicopters are noted as type AIRCRAFT.

20. SHIP CLASS/ACTIVITY LOCATION

(a) The hull number of the ship whose name is used for the class is noted as the ship class, i. e., GEARING class - DD 710 = class.

(b) Activities. The location of the activity is noted. A general location rather than the specific one issued, i. e., all activities on San Francisco Bay (Mare Island, Hunters Point, Alameda) are noted as SAN FRANCISCO. The summary by Specific Location - Ashore, will give the vocabulary already used as well as the index.

(c) Aircraft sources have the aircraft type filled in here, i. e., HELO, A6, E1 B/E2B, etc.

21. SOURCE TYPE

(a) One box may be X'd to indicate whether the spill source is a ship, activity, or aircraft.

(b) If the source is unknown then no box is checked.

22. REMARKS

Remarks and amplifying information is given here. Include added information on containment, clean up, who reported (if the source didn't), etc.

APPENDIX B

This appendix contains a single page example of the Fifth Naval District Oil Spill Record obtained from the Navy Public Works Center in Norfolk, Virginia. The information on oil spills dated from 1970 to the middle of 1974. The number of hours used to complete an oil spill clean-up includes travel time to and from the scene; time to launch and recover equipment; time to recover the oil; time to clean all of the equipment used; and time used for disposal of the recovered oil. In computing charges for oil spill clean-ups, there are no separate charges for labor, material and equipment. Instead, there is an hourly rate that covers the entire scope of work. For FY74, $13.00 per hour charge was established.

FIFTH NAVAL DISTRICT OIL SPILL RECORD

Date	Time	Equipment	Gallons Removed	Oil Type	Manhours
10/16	1115	AC	150	D	20
10/12	1150	CD	200	D	28
10/8	0930	AC	40	D	14
10/5	1330	ABC	40	B	30
10/2	0730	ABC	60	D	32
10/2	0730	ABC	130	D	40
10/1	0730	ABC	800	D	90
9/30	0925	A	520	D	120
9/28	0730	ABC	120	B	40
9/27	1045	ABC	280	B	80
9/21	0730	AC	320	B	40
9/17	1000	AC	120	A	18
9/16	1900	AC	30	B	8
9/14	1400	ABC	80	A	28
9/13	0715	ABC	80	A	24
9/12	0730	ABC	240	A	40
9/10	0730	AC	60	C	16
9/9	0730	AC	480	C	48

Equipment Type

A. Boat

B. Boom

C. Forklift

D. Tank Truck

Oil Types

A. Mixed

B. Navy Special

C. Bunker C

D. Distillate

E. Lube Oil

APPENDIX C

ON-SCENE OPERATIONAL TEAM REQUIREMENTS

Oil spills are not new; however, pre-planned response to oil spill is in the embryonic stage. Lacking detailed experience to use as a basis, the following minimum requirements are recommended for each NOSOT. It is further recommended that the NOSOT Leader be an officer (0-3 or higher).

ON-SCENE OPERATIONAL TEAM PERSONNEL

NUMBER		POSITION DESCRIPTION
1		NOSOT Leader
1		Yeoman/Storekeeper
	PICK-UP TEAM	
1		Coxswain/Bow Supervisor
1		Pump Deck Engineer
2		Bow Workers
	BOOM TEAMS	
1		Boom Placement Boat Coxswain
1		Boom Anchor Boat Coxswain/Driver
1		Boom Anchor Boat Worker
	BEACH & PIER TEAM	
2		Workers
	MISCELLANEOUS	
2		Laborer/Reliefs
13		

ON-SCENE OPERATIONAL TEAM EQUIPMENT/MATERIAL

AMOUNT	ITEM	RECOMMENDED TYPE
1	Oil Pickup Device	Self-propelled or craft/ boat mountable with capability of 70% or better pickup of oil per pass (300-700 gallons per hr).
1	Sludge Barge	
3000 ft.	Containment Boom	Minimum 8" sail, 24" skirt with weighted skirt.
150-300	Shackles	Of appropriate size for connecting boom.
2	Boom Boats	Sufficient size and horse power to handle boom.
20 gals.	Monomolecular (piston) film	Cut with 40% solvent.
5 gals.	Solvent	2 Ethyl Butane.
3	Squirt-type oil cans or back-pack insecticide sprayers	
100 cu. ft.	Sorbents	
1	Wringer Device	Capable of squeezing oil from mats/reusable type sorbents.
1	Loose sorbent pickup device	Self-propelled or craft mountable.
1	Foam proportioning apparatus	Duplex foam proportiner, Hale water motor or NPU nozzle.
1 - 50 ft. length	Fire Hose	1-1/2 O/D.
2	Pumps	P-250.
1	Pick-up Truck	1/4 or 1/2 ton.
As required	Radio	
25	Close-tined pitch forks	

AMOUNT	ITEM	RECOMMENDED TYPE
25	Short-handled grain shovels	
12	Bamboo leaf rakes	
2	Sample containers	1 quart fruit jars (Use aluminum foil between jar and lid)

Plus various appropriate tools, manuals, lubricants for maintenance at the scene [3].

APPENDIX D

The program contained in this appendix tests the retrieval system discussed in chapter four. The master file, placed on a data cell, contained eighty-two completed records and six initial reports. The input file, IN-FILE, contained six after action reports. The program reads the control field number from the first after action report and searches the master file for a matching control field number. If the search is successful, the value of TIPE-1 is checked. An 'A' in the TIPE-1 field denotes an initial report, a 'B' denotes a completed record. If the value of TIPE-1 is 'B', the control field number and the message 'RECORD ALREADY UPDATED' is printed out. If the value of TIPE-1 is 'A', its value is changed to 'B' and the information in the after action report is moved into the master file. If the search is unsuccessful, the control field number and the message 'RECORD CANNOT BE FOUND' is printed out. The process is then repeated.

```
IDENTIFICATION DIVISION.
PROGRAM-ID. THESIS.
ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
SOURCE-COMPUTER. IBM-360.
OBJECT-COMPUTER. IBM-360.
INPUT-OUTPUT SECTION.
FILE-CONTROL.
    SELECT MASTER-FILE ASSIGN TO UT-S-TAPE.
    SELECT IN-FILE ASSIGN TO UR-S-IN1.
    SELECT OUT-FILE ASSIGN TO UR-S-OUT1.
DATA DIVISION.
FILE SECTION.
FD  MASTER-FILE
    BLOCK CONTAINS 25 RECORDS
    LABEL RECORDS ARE STANDARD
    RECORDING MODE IS F
    DATA RECORDS ARE MAS-RCD, MAS-RCD2, MAS-RCD3.
01  MAS-RCD.
    03  TIPE-1          PIC X.
    03  SEQ-NUM         PIC 9(8).
    03  YEAR            PIC 99.
    03  CL-MD           PIC X.
    03  LOCATION        PIC X.
    03  SH-AC-NM        PIC X(25).
    03  SHTPE           PIC 9(4).
    03  SL-DES          PIC X.
    03  HL-UIC          PIC 9(5).
    03  PORT            PIC X(32).
01  MAS-RCD2.
    03  TPE             PIC X(5).
    03  MONTH           PIC 99.
    03  TRIHR           PIC 9(4).
    03  IN-OUT          PIC 9(4).
    03  AMT-RC          PIC 9(7).
    03  COST            PIC 9(8)V99.
    03  MN-HRS          PIC 9999V9.
    03  SEA-ST          PIC 9.
    03  FUEL            PIC X.
    03  CAUSE           PIC X.
    03  EQ1             PIC X.
    03  AMT1            PIC 9.
    03  LEN1            PIC 9(5).
    03  EQ2             PIC X.
    03  AMT2            PIC 99.
    03  LEN2            PIC 9(5).
    03  EQ3             PIC X.
    03  AMT3            PIC 99.
    03  LEN3            PIC 9(5).
    03  EQ4             PIC X.
    03  AMT4            PIC 9(4).
    03  LEN4            PIC 9(5).
    03  CLN-MD          PIC X.
    03  CON-MD          PIC X.
    03  EQ5             PIC X.
    03  TE              PIC 9(4).
01  MAS-RCD3.
    03  AMT-SPT         PIC 9(7).
    03  LNGTH           PIC 9(7).
    03  WIDTH           PIC 9(7).
    03  COM-DT          PIC 9(6).
    03  WIN-SP          PIC 999.
    03  WIN-DIR         PIC 999.
    03  CHEM5           PIC X(10).
    03  CHEM6           PIC X(10).
    03  EQ6             PIC X.
    03  AMT6            PIC 9(4).
    03  AMT5            PIC 9(4).
    03  FILLER          PIC X(18).
FD  IN-FILE
    LABEL RECORDS ARE OMITTED
    BLOCK CONTAINS 5 RECORDS
```

```
     DATA RECORDS ARE IN-RCD, IN-RCD1.
01   IN-RCD.
     03   TIPE-2              PIC X.
     03   SEQ-NUM-2           PIC 9(8).
     03   TPE                 PIC X(5).
     03   MONTH               PIC 99.
     03   TRIHR               PIC 9(4).
     03   IN-OUT              PIC 9(4).
     03   AMT-RC              PIC 9(7).
     03   COST                PIC 9(8)V99.
     03   MN-HRS              PIC 9999V9.
     03   SEA-ST              PIC 9.
     03   FUEL                PIC X.
     03   CAUSE               PIC X.
     03   EQ1                 PIC X.
     03   AMT1                PIC 9.
     03   LEN1                PIC 9(5).
     03   EQ2                 PIC X.
     03   AMT2                PIC 99.
     03   LEN2                PIC 9(5).
     03   EQ3                 PIC X.
     03   AMT3                PIC 99.
     03   LEN3                PIC 9(5).
     03   EQ4                 PIC X.
     03   AMT4                PIC 9(4).
     03   CLN-MD              PIC X.
     03   CON-MD              PIC X.
     03   EQ5                 PIC X.
01   IN-RCD1.
     03   LEN4                PIC 9(5).
     03   TE                  PIC 9(4).
     03   CHEM5               PIC X(10).
     03   CHEM6               PIC X(10).
     03   EQ6                 PIC X.
     03   AMT6                PIC 9(4).
     03   AMT5                PIC 9(4).
     03   FILLER              PIC X(42).
FD   OUT-FILE
     LABEL RECORD IS OMITTED
     BLOCK CONTAINS 5 RECORDS
     DATA RECORD IS LINE-OUT2.
01   LINE-OUT2.
     03   FILLER              PIC X(10).
     03   NUM                 PIC X(8).
     03   FILLER              PIC X(10).
     03   ERR                 PIC X(105).
WORKING-STORAGE SECTION.
77   MES  PIC X(23)  VALUE 'RECORD CAN NOT BE FOUND'.
77   MES2  PIC X(20)  VALUE 'RECORD ALREADY UPDATED'.
77   B                   PIC X          VALUE 'B'.
PROCEDURE DIVISION.
OPEN-FILES.
     OPEN INPUT IN-FILE, INPUT MASTER-FILE,
     OUTPUT OUT-FILE.
     GO TO PAR-1.
FIN.
     READ MASTER-FILE, AT END GO TO CLOSE-FILES.
PAR-1.
     READ IN-FILE, AT END GO TO CLOSE-FILES.
PAR-2.
     READ MASTER-FILE, AT END GO TO NO-RCD.
     IF SEQ-NUM-2 = SEQ-NUM OF MAS-RCD GO TO F-RCD.
     PERFORM FIN 2 TIMES.
     GO TO PAR-2.
NO-RCD.
     MOVE SPACES TO LINE-OUT2.
     MOVE SEQ-NUM-2 TO NUM.
     MOVE MES TO ERR.
     CLOSE MASTER-FILE.
     WRITE LINE-OUT2 AFTER ADVANCING 2 LINES.
     READ IN-FILE, AT END GO TO CLOSE-FILES.
     OPEN INPUT MASTER-FILE.
```

```
           GO TO PAR-1.
       F-RCD.
           IF TIPE-1 OF MAS-RCD = B GO TO ERR-RCD.
           MOVE TIPE-2 TO TIPE-1 OF MAS-RCD.
           READ MASTER-FILE, AT END GO TO CLOSE-FILES.
           MOVE CORRESPONDING IN-RCD TO MAS-RCD2.
           READ IN-FILE, AT END GO TO CLOSE-FILES.
           MOVE CORRESPONDING IN-RCD1 TO MAS-RCD2.
           READ MASTER-FILE, AT END GO TO CLOSE-FILES.
           MOVE CORRESPONDING IN-RCD1 TO MAS-RCD3.
           GO TO PAR-1.
       ERR-RCD.
           MOVE SPACES TO LINE-OUT2.
           MOVE SEQ-NUM-2 TO NUM.
           MOVE MES2 TO ERR.
           WRITE LINE-OUT2 AFTER ADVANCING 2 LINES.
           READ IN-FILE, AT END GO TO CLOSE-FILES.
           PERFORM FIN 2 TIMES.
           GO TO PAR-1.
       CLOSE-FILES.
           CLOSE MASTER-FILE IN-FILE OUT-FILE.
           STOP RUN.
```

APPENDIX E

This appendix contains an example of the proposed Accidental Oil Spill Report that could be forwarded to the NAOSC in the Fifth Naval District. The report contains many of its former summaries, however it also contains example summaries of the vessel traffic in the harbor and the cost, equipment, and manhour figures mentioned in chapter six.

The number of vessels in the harbor per occurrence was assigned arbitrarily considering that the average number of naval ships in the Norfolk harbor is 35 to 40 per month and about 60 civilian ships at the naval piers per month also. The equipment, cost, and manhour figures were obtained from the Navy Public Works Center in Norfolk, Virginia for the last six months of 1973. In computing charges an hourly rate was used. For FY74, $13.00 per hour charge was broken down as follows:

Labor	$10.92
Material	.78
Equipment Rental	1.30
	$13.00

FUEL TYPE	NUMBER OF OCCURENCES	PERCENT OF TOTAL OCCURENCES	TOTAL VOLUME RECOVERED (GALS)	AVERAGE PER OCCURENCE (GALS)
NAVAL SPECIAL FUEL OIL	22	26.8	3620	164.5
NAVAL DISTILLATE	35	42.6	6890	196.8
JET FUEL	1	1.2	40	40.0
MARINE DIESEL		0.0		0.0
LUBE OIL	3	3.6	810	270.0
GASOLINE		0.0		0.0
HYDRAULIC FLUID		0.0		0.0
OIL WATER WASTE	1	1.2	40	40.0
DIESEL		0.0		0.0
BUNKER C	6	7.3	935	155.8
MIXTURE	12	14.6	1520	126.6
OTHER	2	2.4	90	45.0
TOTAL	82		13945	

VOLUME RANGE	NUMBER OF OCCURENCES	PERCENT OF TOTAL OCCURENCES	TOTAL VOLUME RECOVERED (GALS)	AVERAGE PER OCCURENCE (GALS)
0 - 50	22	26.8	840	38.1
51 - 100	15	18.2	1185	79.0
101 - 200	21	25.6	3220	153.3
201 - 400	18	21.9	5190	288.3
401 - 600	4	4.8	1890	472.5
601 - 800	1	1.2	800	800.0
801 - 1000	1	1.2	820	820.0
1001 - 2000		0.0		0.0
2001 - 5000		0.0		0.0
> 5000		0.0		0.0
TOTAL	82		13945	

CAUSE	NUMBER OF OCCURENCES	PERCENT OF TOTAL OCCURENCES	TOTAL VOLUME RECOVERED (GALS)	AVERAGE PER OCCURENCE (GALS)
VALVE MISALIGN OR OPEN	10	12.1	2110	211.0
TANK OVERFLOW	11	13.4	735	66.8
FUEL TRANSFER INTERNAL	15	18.2	770	51.3
FUEL TRANSFER EXTERNAL	14	17.0	4480	320.0
MONITORING ERROR	11	13.4	1050	95.4
DONUT		0.0		0.0
COLLISION	3	3.6	1460	486.6
GROUND		0.0		0.0
STRUCTURAL DESIGN FAILURE	5	6.0	1910	382.0
AIR IN LINE	9	10.9	1190	132.2
UNKNOWN	2	2.4	160	80.0
OTHER	2	2.4	80	40.0
TOTAL	82		13945	

TIME	NUMBER OF OCCURENCES	TOTAL VOLUME RECOVERED
0000 - 0400	1	90
0400 - 0800	47	8980
0801 - 1200	17	2920
1201 - 1600	15	1885
1601 - 2000	2	70
2001 - 2400		
TOTAL	82	13945

SEA STATE	NUMBER OF OCCURENCES	TOTAL VOLUME RECOVERED
01	3	260
02	6	555
03	19	1950
04	14	1525
05	17	2585
06	9	1540
07	8	2860
08	5	2270
09	1	400
TOTAL	82	13945

MONTH	NUMBER OF OCCURENCES	PERCENT OF TOTAL OCCURENCES	TOTAL VOLUME RECOVERED (GALS)	AVERAGE PER OCCURENCE (GALS)
JANUARY		0.0		0.0
FEBRUARY		0.0		0.0
MARCH		0.0		0.0
APRIL		0.0		0.0
MAY		0.0		0.0
JUNE		0.0		0.0
JULY	18	21.9	4755	264.1
AUGUST	7	8.5	780	111.4
SEPTEMBER	16	19.5	2845	177.8
OCTOBER	13	15.8	2280	175.3
NOVEMBER	22	26.8	3040	138.1
DECEMBER	6	7.3	245	40.8
TOTAL	82		13945	

VESSELS IN HARBOR	NUMBER OF OCCURENCES	PERCENT OF TOTAL OCCURENCES	TOTAL VOLUME RECOVERED (GALS)	AVERAGE PER OCCURENCE (GALS)
0 - 20		0.0		0.0
21 - 30	1	1.2	240	240.0
31 - 40	2	2.4	160	80.0
41 - 50	3	3.6	440	146.6
51 - 60	13	15.8	1565	120.3
61 - 70	27	32.9	4760	176.2
71 - 80	12	14.6	1800	150.0
81 - 90	12	14.6	1440	120.0
91 - 100	9	10.9	3360	373.3
> 100	3	3.6	180	60.0
TOTAL	82		13945	

Vessel Type	Number of Occurences	Percent of Total Occurences	Total Volume Recovered Per (Gals)	Average Occurence (Gals)
CVA	4	4.8	510	127.5
CVS	2	2.4	300	150.0
CVAN		0.0		.0.0
CARRIERS	6	7.3	810	135.0
CA		0.0		0.0
CG	1	1.2	40	40.0
CLG	1	1.2	120	120.0
CRUISERS	2	2.4	160	80.0
DD	8	9.7	1550	193.7
DDG	7	8.5	715	102.1
DLG	3	3.6	260	86.6
DESTROYERS	18	21.9	2525	140.2
DE	4	4.8	890	222.5
DEG	1	1.2	40	40.0
DER	2	2.4	100	50.0
OCEAN ESCORTS	7	8.5	1030	147.1
SS	1	1.2	240	240.0
SSBN		0.0		0.0
SSN		0.0		0.0
SUBMARINES	1	1.2	240	240.0
LCC	1	1.2	200	200.0
LKA	2	2.4	560	280.0
LPA	3	3.6	140	46.6
LPD	5	6.0	495	99.0
LPH	3	3.6	185	61.6
LSD	4	4.8	500	125.0
LST	2	2.4	280	140.0
AMPHIBIOUS	20	2.4	2360	118.0
AOR	4	4.8	660	165.0
ARS	6	7.3	1770	295.0
AF	6	7.3	1750	291.6
AO	6	7.3	1380	230.0
AS	3	3.6	420	140.0
CIVIL	1	1.2	320	320.0
UNKWN	1	1.2	480	480.0
OTHER	1	1.2	40	40.0
TOTAL	82		13945	

Equipment	Number of Occurences	Percent of Total Occurences	Average Amount Used Per Occurence	Total Cost
Skimmer		0.0	0.0	.00
Boat	1	1.2	1.0	1560.00
Skimmer, Boom		0.0	0.0	.00
Boat, Boom	1	1.2	175.0	312.00
Boat, Forklift	23	28.0	1.0	7345.00
Boat, Forklift, Boom	55	67.0	269.9	25701.00
Boat, Tank, Truck, Boom		0.0	0.0	.00
Boat, Sorbent, Boom		0.0	0.0	.00
Sorbent		0.0	0.0	.00
Forklift	1	1.2	1.0	364.00
Forklift, Boom	1	1.2	70.0	78.00
Total	82			35360.00

Equipment	Average Cost	Total Manhours	Average Manhours	Average Time Per Occurence
Skimmer	.00	0.0	0.0	0.0
Boat	1560.00	120.0	120.0	120.0
Skimmer, Boom	.00	0.0	0.0	0.0
Boat, Boom	312.00	24.0	24.0	24.0
Boat, Forklift	319.34	565.0	24.5	13.3
Boat, Forklift, Boom	467.29	1969.0	35.8	35.8
Boat, Tank, Truck, Boom	.00	0.0	0.0	0.0
Boat, Sorbent, Boom	.00	0.0	0.0	0.0
Sorbent	.00	0.0	0.0	0.0
Forklift	364.00	28.0	28.0	14.0
Forklift, Boom	78.00	6.0	6.0	6.0
Total		2712.0		

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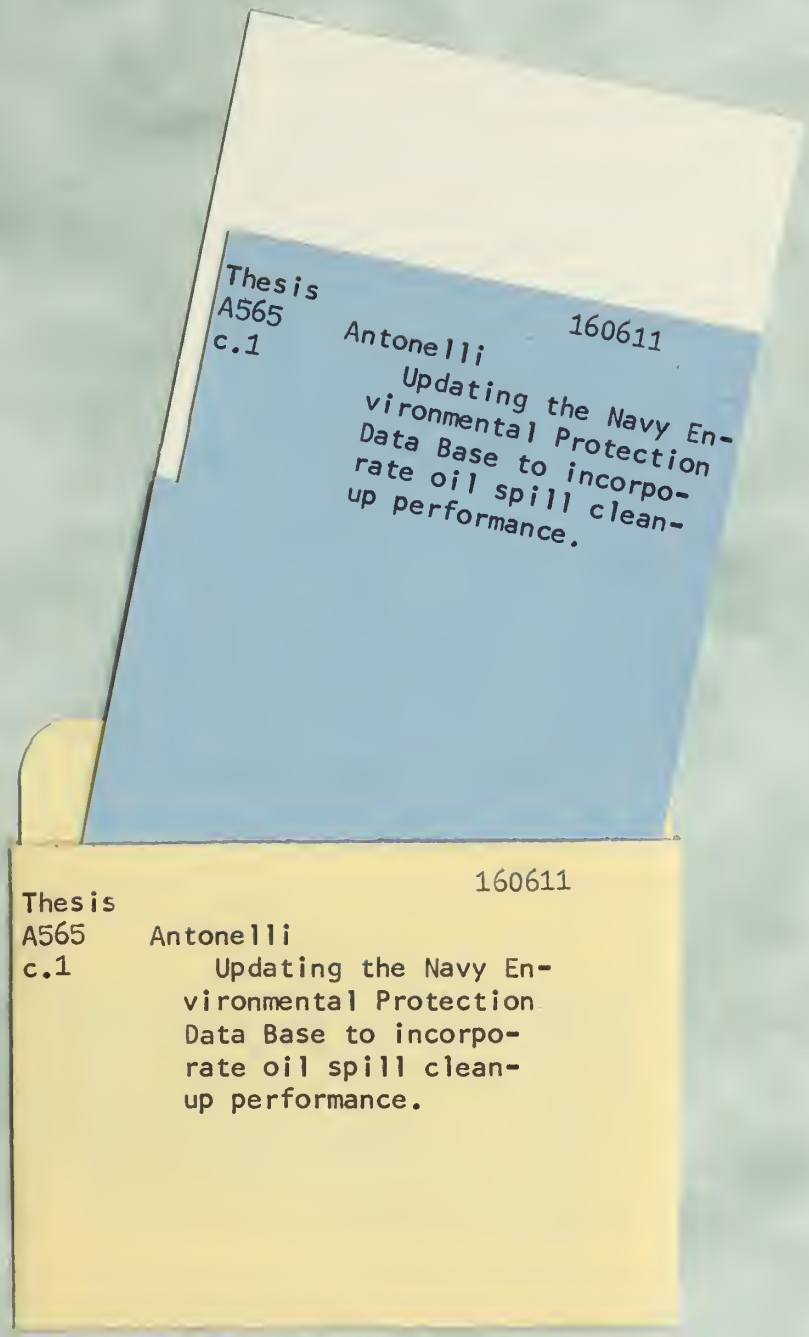

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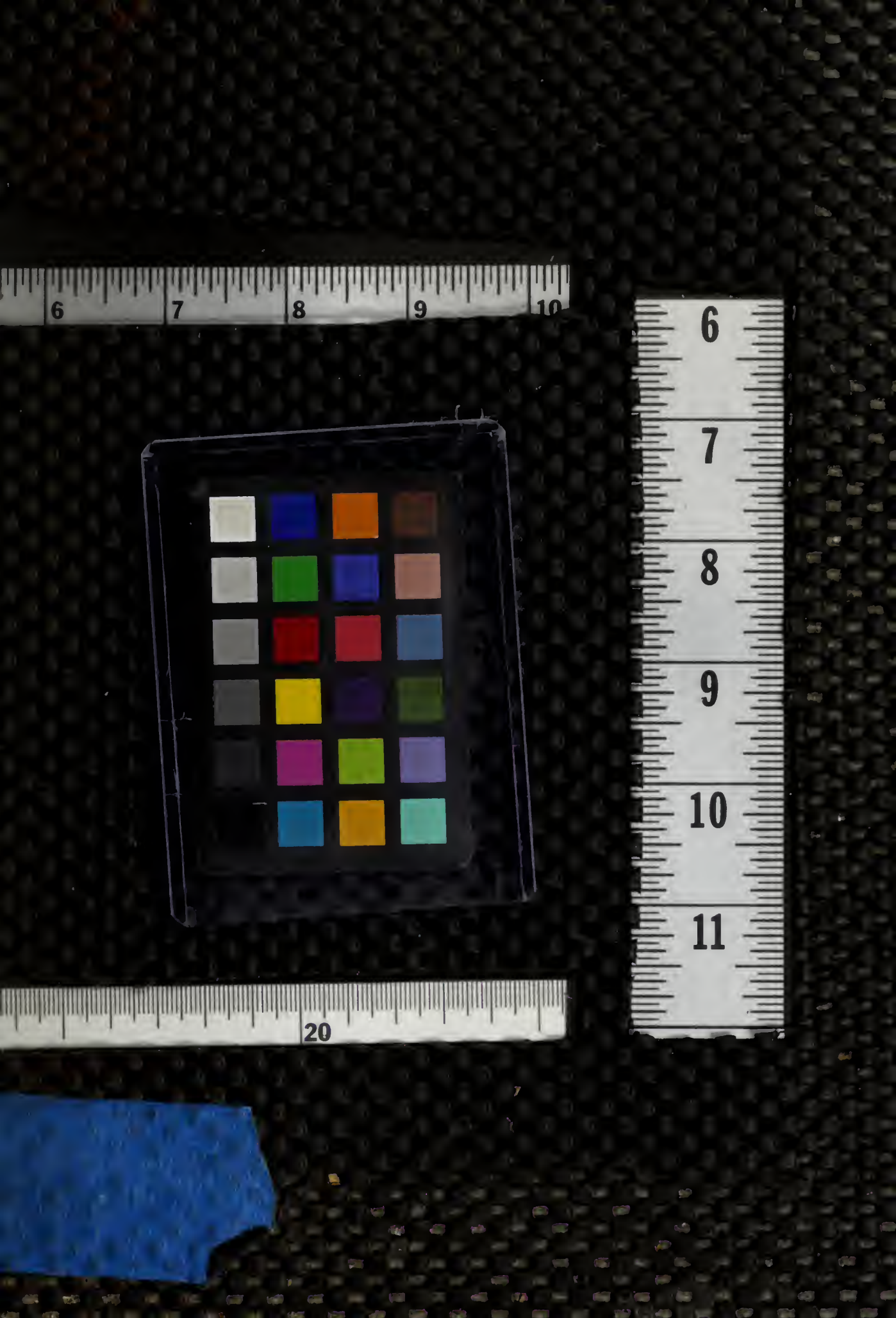
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